



Australian Government

Department of Education, Employment and Workplace Relations

RIIMEX603A Establish and maintain underground mining ground control and stable mining systems

Release: 1

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Modification History

Not applicable.

Unit Descriptor

This unit covers establishing and maintaining ground control and stable mining systems in underground metalliferous mines. It includes: identifying and evaluating the criteria, the geological and geotechnical information, the mining engineering principles and practices, and control options for the system; establishing the system; and auditing and reviewing the effectiveness of the system.

Application of the Unit

This unit covers the application of the principles of mine design to the establishment and ongoing development of stable mining systems. It is appropriate for those working in a management or technical specialist role, in underground operations within:

- Metalliferous mining

Licensing/Regulatory Information

Refer to Unit Descriptor.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify and evaluate the criteria	1.1. Access, interpret and apply compliance documentation relevant to ground control and stable mining systems in underground metalliferous mines 1.2. Identify, collect, access and interpret mine survey data in accordance with statutory and site requirements 1.3. Identify and record the necessary resources required to create and maintain a stable mining structure 1.4. Identify, evaluate and record historical information relating to the mine site 1.5. Identify, assess and record all possible mining structure failure modes relevant to the mine site 1.6. Establish the criteria for establishing the quantitative stability of mining structures 1.7. Analyse the risks associated with unstable mining structures 1.8. Identify and assess the limitations and controls applying to design of stable mining structures
2. Identify and evaluate geological and geotechnical information	2.1. Identify and evaluate exploration techniques 2.2. Identify and evaluate geological structures 2.3. Identify and evaluate hydrogeological features 2.4. Identify and evaluate hanging wall, foot wall, ore body characteristics and physical properties 2.5. Identify and evaluate stress regimes
3. Identify and evaluate mining engineering principles and practices	3.1. Identify and evaluate mining system types and methods 3.2. Identify potential layouts for stable mining structures from engineering analysis 3.3. Identify and evaluate mining constraints impacting on the development of a stable mining structure 3.4. Identify and evaluate equipment requirements, appropriate for the

	development and maintenance of a stable mining structure
4. Identify and evaluate control options	4.1. Identify and evaluate ground support systems 4.2. Identify and evaluate ground support installation, monitoring and assessment systems 4.3. Identify and evaluate causes and impacts of failure mechanisms 4.4. Identify and evaluate natural and induced stress control methods
5. Establish the system	5.1. Design and establish exploration programs identifying geological features and characteristics impacting on mining operations 5.2. Design and establish methods of entry 5.3. Design and establish systems of mining 5.4. Design and establish sequences for mining operations 5.5. Design and establish system specifications and documentation 5.6. Establish a program, including systems and procedures to satisfy identified training requirements 5.7. Establish emergency response and evacuation plans and procedures in accordance with site requirements 5.8. Establish standard operating procedures and incorporate into site documentation
6. Audit and review the effectiveness of the system	6.1. Audit stable structure standards for compliance with statutory and site requirements 6.2. Audit mine survey data for compliance with statutory and site requirements 6.3. Audit monitoring systems for compliance with statutory and site standards 6.4. Audit recording systems for compliance with statutory and site requirements 6.5. Audit system maintenance program and procedures for compliance with statutory and site requirements 6.6. Audit emergency plans for compliance with statutory and site requirements

	6.7. Audit the stable mining structure training program for currency, relevance and compliance with the site requirements 6.8. Audit emergency response and evacuation plans and procedures for compliance with site requirements 6.9. Identify and assess future site mining requirements and standards and incorporate into the planning procedures as stipulated by the ground control and stable mining structure system 6.10. Establish procedures for response to instances of non-compliance or other discrepancies/deficiencies revealed by audit
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Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills

Specific skills are required to achieve the performance criteria in this unit, particularly for the application in the various circumstances in which this unit may be applied. This includes the ability to carry out the following as required to establish and maintain ground control and stable mining systems in underground metalliferous mines:

- apply legislative, organisation and site requirements and procedures
- access, interpret and apply technical information
- access, interpret and apply mine survey information
- access and analyse archival and historical failure information related to the mine
- interpret and apply mathematical and scientific theorems/laws related to stable mining systems
- perform mathematical calculations
- interpret and apply design criteria for stable mining systems
- interpret computer spreadsheets and stable mining systems modelling/simulations
- collect, collate and interpret mining data
- apply procedures for preparing technical procedures
- apply procedures for conducting enquiries/investigations and preparing reports
- apply effective communications
- access data from monitoring systems and equipment
- analyse and report on stable mining systems training needs
- apply risk management processes and techniques

Required knowledge

Specific knowledge is required to achieve the Performance Criteria of this unit, particularly its application in a variety of circumstances in which the unit may be used. This includes knowledge of the following, as required to establish and maintain ground control and stable mining systems in underground metalliferous mines:

- legislative and statutory requirements for mining structures including mine plans, ground support and safety management systems
- mine planning and design
- the systems of mining including drives, cross-cuts, rises, winzes, declines, inclines, shafts and ore body development
- stress analysis including mining induced stress, vertical and horizontal stress tectonics
- rock types and characteristics including subsidence, faults and fissures, permeability of rock types, hydrology, physical property testing, caving characteristics, windblast and hanging wall and foot wall conditions
- systems of work including mining and extraction such as pillar recovery and the use of various types of fill material

- mining structure failure modes
- exploration techniques
- mining and general engineering principles relevant to the behaviour of excavations in rock
- ground support methods and systems
- audit methodologies
- pillar design criteria:
- pillar stress/strain/strength/ratios
- width/height ratios
- roof support design criteria
- Mohr's Circle
- Young's Modulus
- Poisson's Ratio
- stress distribution diagrams
- factors of safety
- mine surveying

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	
Critical aspects for assessment and evidence required to demonstrate competency in this unit	The evidence required to demonstrate competency in this unit must be relevant to worksite operations and satisfy all of the requirements of the performance criteria, required skills and knowledge and the range statement of this unit and include evidence of the following: • knowledge of the requirements, procedures and instructions for the establishing and maintaining of ground control and stable mining systems in underground metalliferous mines • implementation of procedures and techniques for the safe, effective and efficient establishing and maintenance of ground control and stable mining systems in underground metalliferous mines • the identification of the relevant information and scope of the work required to meet the required outcomes • the identification of viable program options and the selection of systems that best meet the required outcomes • working with others to establish and maintain ground control and stable mining systems in underground metalliferous mines • consistent and timely establishing and maintenance of ground control and stable mining systems in underground metalliferous mines
Context of and specific resources for assessment	• This unit must be assessed in the context of the work environment. Where personal safety or environmental damage are limiting factors, assessment may occur in a simulated environment provided it is realistic and sufficiently rigorous to cover all aspects of workplace performance, including task skills, task management skills, contingency management skills and job role environment skills.

	• The assessment environment should not disadvantage the participant. For example, language, literacy and numeracy demands of assessment should not be greater than those required on the job. • Customisation of assessment and delivery environment to sensitively accommodate cultural diversity. • Aboriginal people and other people from a non English speaking background may have second language issues. • Assessment of this competency requires typical resources normally used in the work environment. Selection and use of resources for particular worksites may differ due to site circumstances. • Where applicable, physical resources should include equipment modified for people with disabilities. • Access must be provided to appropriate learning and/or assessment support when required.
Method of assessment	This unit may be assessed in a holistic way with other units of competency. The assessment strategy for this unit must verify required knowledge and skill and practical application using more than one of the following assessment methods: • written and/or oral assessment of the candidate's required knowledge • observed, documented and/or first hand testimonial evidence of the candidate's: • implementation of appropriate procedures and techniques for the safe, effective and efficient achievement of the required outcomes • identification of the relevant information and scope of the work required • identification of viable options and the selection of systems that best meet the required outcomes • consistently achieving the required outcomes • first hand testimonial and documentary evidence of the candidate's:

	• working with others to establish and maintain ground control and stable mining systems in underground metalliferous mines • consistent and timely gaining of approval of ground control and stable mining systems in underground metalliferous mines • provision of clear, timely required support and advice on the implementation of ground control and stable mining systems in underground metalliferous mines
Guidance information for assessment	Consult the SkillsDMC User Guide for further information on assessment including access and equity issues.

Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Relevant compliance documentation may include:	• legislative, organisation and site requirements and procedures • manufacturer's guidelines and specifications • Australian standards • codes of practice • Employment and Workplace Relations legislation • Equal Employment Opportunity and Disability Discrimination legislation
Resources may include:	• skilled personnel • bolts, cable and grout • face drilling equipment • power systems • mine services • special application equipment • budgetary requirements
Stable mining structure controls include:	• mine opening dimensions • pillar sizes • influences of stresses and depth • strength of rock types • stress regimes and base characteristics • rock characteristics • competency of fill • system of mining • sequence of mining • competency of ground support • direction of mining • stress shadow area • faults and fissures
Mine site historical information may include:	• caving characteristics • existence of previous workings within the mine • hanging wall and footwall data • hydrology

	• mass blasts • over and underlying rock types • permeability of rocks and faults • physical property testing results of rock types • rockburst and seismic activity • sedimentology aspects of the mine site relating to subsidence • sulphide dust explosions • underground fissures and water sources • water pumped from mine
Risk is:	• The chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood
Mine design is the process of:	• engineering analysis applied to the systems and sequences involved in mining
Mine design may include in whole or in part requirements relating to:	• cross-cuts • declines/inclines • drives • fault monitoring • geology • hanging wall and foot wall technical data • legislative and statutory requirements • mine drainage • mine plant • mining induced stress • modelling • multiple ore bodies • ore grades • outburst • over and underlying rock types • partial extraction • pillar extraction • sequencing • shaft pillar • shaft sinking and shaft location • spontaneous combustion • stone drivage • subsidence • sulphide content of ore • ventilation • windblast
Geological and hydrogeological	• caving characteristics

information includes that related to:	• direction and competency of faults or inliers • hanging wall and foot wall • induced collapse • intrusions and deformities • over and underlying rock types • permeability of rocks and faults • physical properties • subsidence • sulphide content of ore • underground fissures and water sources • windblast
Stress includes:	• horizontal and vertical tectonic induced stress • mining induced stress • primary and secondary stress fields
Mining systems and methods may include:	• cut and fill • mechanised cut and fill • shrinkage stoping • sub-level stoping • open stoping • bench stoping • panel stoping • pillar extraction • caving methods • post pillar • slots mining
Monitoring of activities may include:	• review of written reports • performance appraisal • auditing procedures
Standard operating procedures (SOP) are also known as:	• safe working procedures, safe operating procedures and standard working procedures
Audit is defined as:	• a systematic examination against defined criteria to determine whether activities and related results conform to planned arrangement, and whether these arrangements are implemented effectively and are suitable to achieve the organisation's policy and objectives

Unit Sector(s)

Materials Extraction

Competency field

Refer to Unit Sector(s).

Co-requisite units

Not applicable.